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# OPERATING EXPERIENCE WEEKLY SUMMARY

## Office of Nuclear and Facility Safety

**October 30 - November 5, 1998**

**Summary 98-44**

# Operating Experience Weekly Summary 98-44

*October 30 through November 5, 1998*

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# *EVENTS*

## 1. AIR COMPRESSOR CATASTROPHICALLY FAILS AT IDAHO

On November 4, 1998, at the Idaho National Engineering Environmental Laboratory Waste Experimental Reduction Facility, an operator was thrown against an air receiver and into a concrete wall from the concussion following a catastrophic air compressor failure. Compressor parts, debris, and oil were propelled into the south end of the compressor room, immediately filling it with atomized lubricating oil and smoke. The operator activated a manual fire alarm as he exited the room, evacuating the building. He was dazed and covered with a dark oil spray, but otherwise uninjured. The facility fire department responded to the scene and determined there was no fire. Fire department personnel and industrial hygienists released the building for entry after it had been properly ventilated, but access to the air compressor room has been restricted to preserve the accident scene until an investigation can be completed. Figure 1-1 shows the failed end of the air compressor. OEAF engineers will follow the accident investigation and provide information as it becomes available. (ORPS Report ID--LITC-WERF-1998-0008)

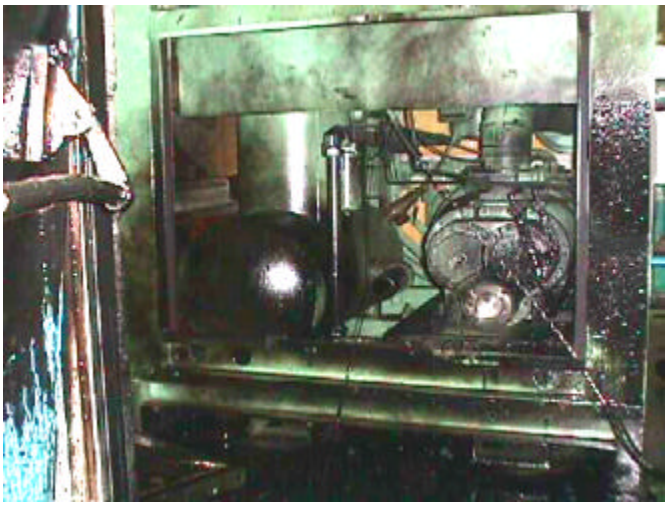

**Figure 1-1. Air Compressor**

**KEYWORDS:** accident, air compressor

**FUNCTIONAL AREAS:** Lessons Learned, Industrial Safety, Hazards and Barrier Analysis

## 2. CRANE MAINTENANCE TECHNICIAN RECEIVES ELECTRICAL SHOCK

On November 3, 1998, at the Lawrence Berkeley National Laboratory, a subcontract crane maintenance technician received an electrical shock when his hand came into contact with the 480-volt crane rail power source. A building employee heard the technician's shouts and observed him "frozen" to the rail. The building employee shut down the crane's power supply and notified the Laboratory fire department. The maintenance technician suffered disorientation and light burns to his right hand but remained conscious. Medical personnel evaluated his condition and released him, without hospitalization, the same afternoon. Laboratory and DOE personnel will conduct an accident investigation. OEAF engineers will follow the accident

investigation and provide information as it becomes available. (ORPS Report SAN--LBL-OPERATIONS-1998-0003)

**KEYWORDS:** electrical hazard, lockout and tagout, maintenance

**FUNCTIONAL AREAS:** Industrial Safety, Procedures

## 3. CONTAMINATION AREA BOUNDARY IMPROPERLY MOVED

On October 26, 1998, at the Hanford Site Analytical Laboratory, a millwright working inside a temporary contamination area repositioned the boundary rope, reducing the size of the contamination area. He did this without consulting the radiological control technician who was supporting work inside the contamination area. Violations of radiation work permit requirements can result in the exposure of personnel to radiation and the spread of contamination. (ORPS Report RL--PHMC-ANALLAB-1998-0035)

Workers were performing work on a remote manipulator in accordance with a radiation work permit that required them to establish a temporary contamination area using a rope boundary. Investigators determined that a chemical technologist requested a millwright working inside the contamination area to move the boundary rope so that he could use a hot cell manipulator adjacent to the temporary contamination area. Two facility evaluation board members observed the millwright move the boundary rope approximately 16 inches. They reported their observations to the radiological control technician, who performed smear surveys and detected no contamination. The facility manager will issue a lessons learned/letter of expectation to plant personnel highlighting the requirements for maintaining radiological boundary control and effective communication, and for getting the right personnel involved when a boundary needs to be changed.

NFS has reported willful radiation work permit violations in several Weekly Summaries. NFS also reported assessments of civil penalties for radiation protection violations under the Price-Anderson Amendments Act in several Weekly Summaries. Following are some examples.

- Weekly Summary 98-36 reported that two subcontractor workers at the Nevada Test Site entered a contaminated area in violation of postings. The workers ignored radiological posting and the presence of a fully dressed-out radiological control technician. A radiological worker noticed the workers and told them to stop and return to the barrier line. (ORPS Report NVOO--BNLV-NTS-1998-0024)

- Weekly Summary 97-01 reported that the DOE Office of Enforcement and Investigation issued a Preliminary Notice of Violation under the Price-Anderson Amendments Act to Petsco and Son, Inc., a general contractor to Brookhaven National Laboratory, and an Enforcement Letter to the Laboratory for four noncompliances with 10 CFR 835 requirements. Two of the noncompliances involved subcontractor personnel moving yellow and magenta barrier rope used to establish radiation areas. [NTS Report NTS-CH-BH-BNL-PE-1996-0001; letter, DOE (T. O'Toole) to Brookhaven National Laboratory (N. Samios), 12/18/96]

These events illustrate the need for workers to be accountable and consider the consequences of performing work outside the scope of procedures, radiological work permits, and work packages. When workers violate these requirements, they increase the probability of the spread of contamination and exposure to radiation. Workers must guard against complacency when performing routine work.

Personnel working at DOE facilities should have a continually questioning attitude toward safety issues. Each individual is ultimately responsible for complying with rules to ensure personal safety. Facility managers should communicate a sound policy stressing that safety is of prime importance and that all personnel must exhibit an individual commitment to excellence and professionalism. Managers should ensure that radiological protection practices are followed and enforced. Radiological control technicians should consider the impact on operations when placing work area boundaries.

DOE/EH-0256T, *Radiological Control Manual*, states: “Each person involved in radiological work is expected to demonstrate responsibility and accountability through an informed, disciplined, and cautious attitude toward radiation and radioactivity.” The manual sets forth DOE guidance on the proper course of action in the area of radiological control, including work preparation; work controls; monitoring and surveys; and training and qualifications. Section 122, “Worker Attitude,” states: "Minimizing worker radiation exposure can be achieved only if all persons involved in radiological activities have an understanding of and the proper respect for radiation." Section 123, “Worker Responsibilities,” states that trained personnel should recognize that their actions directly affect contamination control, personnel radiation exposure, and the overall radiological environment associated with their work. The first rule of worker responsibility is to obey posted, written, and oral radiological control instructions and procedures, including instructions on radiological work permits.

**KEYWORDS:** radiological work permit, violation

**FUNCTIONAL AREAS:** Radiation Protection

## 4. ENERGIZED EQUIPMENT FOUND AFTER LOCKOUT ESTABLISHED

On October 27, 1998, at the Savannah River Laboratory Technical Area, subcontractors preparing to replace a fire panel found terminals energized to 60 volts inside the panel during a pre-work voltage check. The operations group had approved and established a lockout on the panel the previous day. In accordance with site safety requirements, work controllers had instructed the subcontractors during a pre-job briefing to conduct voltage checks before the start of any work. Inadequate work practices involving electrical energy can cause death or serious injury. (Orps Report SR--WSRC-LTA-1998-0032)

Investigators determined that the fire system is an older system undergoing systematic upgrade, and that as-found conditions associated with this system have deviated from site drawings in the past. They also determined that the source of the voltage discovered before work started was not identified in controlled drawings and electrical schedules.

The facility manager conducted a critique of the event. Critique members learned the following information regarding electrical lockout/tagout issues.

- The site hazardous energy procedure requires electrical voltage checks to be performed, when possible, for verification of isolation.

- Workers performed a walk-down of the lockout points and boundaries established by the operations organization as part of the verification of isolation. Based on past guidance and understandings that restricted access to equipment enclosures, they did not open the fire system panel and perform voltage checks during the verification of isolation.

- Workers signed onto the approved lockout, opened the fire protection system panel, and performed voltage checks before beginning work.

OEAF engineers searched the ORPS database and identified several occurrences where voltage was present in equipment after lockouts had been established. Among these are the following.

- Electricians preparing to remove a failed water heater at Savannah River discovered voltage during a pre-work voltage check after a lockout had been established. Investigators determined that the electrical print used to determine lockout boundaries was erroneous, and that the source of power could not be determined from existing prints. (ORPS Report SR--WSRC-HCAN-1998-0012)

- Maintenance personnel at Savannah River discovered voltage on a temperature switch that was locked out for replacement. Investigators determined that a newly assigned writer failed to include a requirement for a voltage check as a condition of the shift manager's approval because he did not understand the purpose of the step. (ORPS Report SR--WSRC-CIF-1998-0003 and OEWS 98-16)

- Electricians preparing to calibrate a trap level detector at the Oak Ridge Y-12 Site discovered 480 volts on a line that they believed was de-energized and locked out. One of the electricians performed an additional pre-work voltage check as a precautionary measure. Investigators determined that the lockout was inadequately established. (ORPS Report ORO--LMES-Y12NUCLEAR-1998-0074)

- Electricians preparing to replace a 220-volt heater at the Richland Plutonium Finishing Plant stopped work after discovering during a pre-work lockout verification that 110 volts was still available to the heater. Investigators determined that the lockout writers had specified the lockout of only one of a pair of 110-volt supply breakers because configuration drawings indicated that the breakers were ganged together. However, the electricians determined that the breakers were not ganged and only one had been opened and tagged. They stopped work and notified their supervisor. (ORPS Report RL--WHC-PFP-1995-0013)

These events underscore the importance of hazardous energy checks on all electrical lockouts before work begins. The checks are not optional. Inaccuracies in configuration control documents or lack of familiarity with electrical system configurations by lockout writers often lead to inadequately prepared and executed lockouts. Lockout installation and verification, when performed in accordance with inadequate lockout plans, are not likely to correct errors or omissions in the plans. Issues surrounding ownership of equipment and qualifications of personnel may preclude hazardous energy checks before a lockout is established and equipment is turned over for maintenance. Pre-work zero-voltage checks then become the final, positive barrier to injury or death. Facility managers should ensure that work packages require zero-voltage checks and clearly delineate who makes them and when they are made.

Personnel at DOE facilities should have a continually questioning attitude toward safety issues. Each individual is ultimately responsible for complying with rules to ensure personal safety. Facility managers should communicate the idea that safety is of prime importance and that all personnel must be committed to excellence and professionalism. At Richland, for example, a

questioning attitude helped to identify an inadequate lockout, and workers forestalled possible injury by exercising their stop-work authority.

DOE/EH-0557, Safety Notice 98-01, *Electrical Safety*, contains summaries, corrective actions, and recommendations related to electrical events. The notice concludes that personnel error was the direct cause of approximately half of all electrical occurrences, and lists failure to de-energize equipment, failure to correctly lock and tag equipment out of service, and failure to perform zero-energy checks as major contributors to personnel error. Safety Notices are available at http://tis.eh.doe.gov/web/oeaf/lessons_learned/ons/ ons.html.

DOE/ID-10600, *Electrical Safety Guidelines*, prescribes electrical safety standards for DOE field offices and facilities. Included in the guidelines is information on training and qualifications, work practices, protective equipment, insulated tools, and recognition of electrical hazards. DOE-HDBK-1092-98, *Electrical Safety*, contains explanatory material in support of OSHA regulations and nationally recognized electrical safety-related standards. This document addresses electrical safety for enclosed electrical and electronic equipment and discusses the latest editions of 29 CFR 1910 and 29 CFR 1926 and National Fire Protection Association Standard 70E, *National Electrical Code*.

**KEYWORDS:** electrical maintenance, electrical safety, lockout and tagout, voltage

**FUNCTIONAL AREAS:** Industrial Safety, Work Control

## 5. IMPROPER MATERIAL SELECTION RESULTS IN ACID SPILL

On October 26, 1998, at the Savannah River H-Canyon Facility, an operator discovered acid leaking from a sample tap on a tank and immediately notified the control room. Within approximately 20 minutes, the tap assembly broke loose from the tank and the spill rate increased. Operations personnel immediately evacuated personnel from the area, initiated acid spill response procedures, and drained the tank to below the level of the sample tap to stop the leak. Radiological control and industrial hygiene personnel conducted atmospheric sampling and determined that no habitability issues existed. Approximately one quart of 4.6 molar nitric acid was released. The use of incompatible materials can lead to failures that result in process interruptions, safety and health hazards, or environmental damage. (ORPS Report SR--WCRC-HCAN-1998-0036)

The facility manager convened a critique of the incident. Attendees learned that a carbon steel pipe nipple in a newly installed sample tap assembly had corroded rapidly upon exposure to the acid, causing the spill. They also learned that the work package called for installation of a type 304 stainless steel nipple and that workers had taken a zinc-coated carbon steel nipple part from a general consumables bin in shop stores labelled as type 304 stainless steel. Investigators have not yet determined why the part was stored improperly.

OEAF engineers searched the OPRS database and identified several occurrences where the use of incompatible materials led to leaks or spills of hazardous materials. Among these are the following.

- At the Savannah River H-Canyon facility, approximately two gallons of acid leaked from a tank automatic inlet valve soon after operations personnel began to transfer 50 percent nitric acid between two tanks. Investigators determined that acid had corroded through the valve in less than one month after it had been replaced.

They also determined that engineers had specified a valve with stainless steel internals, but had not recognized that the body material was carbon steel. (ORPS Report SR--WSRC-HCAN-1997-0053 and OEWS 97-53)

- At the Rocky Flats Non-Plutonium Operations Area, a carbon steel plug blew out of a brass fitting, releasing approximately 1,000 gallons of domestic hot water. Investigators determined that the plug had corroded over time to the point at which the threads failed. They attributed the incident to an error in material selection. (ORPS Report RFO--KHLL-NONPOUPS1-1995-0037)

- At the Los Alamos Plutonium Processing and Handling Facility, a brass compressed air flowmeter failed and released fluid contaminated with plutonium to a floor area. Investigators determined that acid fumes from a hydrochloric acid solution tank had migrated past an isolation check valve and corroded the flowmeter. Investigators attributed the failure to poor design and the use of materials not compatible with acid. (ORPS Report ALO-LA-LANL-TA55-1992-0009)

These events highlight the importance of proper material selection. Even in systems that are not related to the authorization basis, and where less rigorous procurement, testing, and inspecting requirements apply, improper material selection can have severe environmental, safety, and health consequences. DOE 5700.6C, *Quality Assurance*, specifies criteria for procurement and acceptance testing. These criteria discuss controls for selection and determination of the suitability of purchased items. Other guidelines for parts procurement can be found in DOE-STD-1071-94*, Guidelines to Good Practices for Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance at DOE Nuclear Facilities*.

**KEYWORDS:** acid, corrosion, material compatibility, procurement

**FUNCTIONAL AREAS**: Procurement, Mechanical Maintenance

## 6. OSHA OZONE LIMITS EXCEEDED DURING WELDING AT OAK RIDGE

On October 29, 1998, at the Y-12 Site, industrial hygienists determined that three welders had been exposed to elevated and ozone levels. The welders reported experiencing flu-like symptoms after performing light gas metal arc welding on an aluminum alloy. Investigators determined that levels above 0.7 ppm were generated within the first one to three minutes of welding activity using dragger tubes as a grab sample. All gas metal arc welding on aluminum alloy within the facility was stopped until sampling data can be analyzed and additional controls are in place. Inadequate job hazard analysis can compromise worker health and safety. (ORPS Report ORO--LMES-Y12SITE-1998-0054)

Ozone may be generated by ultraviolet radiation from welding arcs. This is particularly true with gas-shielded arcs, especially when argon is used. The effect is magnified if the welding materials or nearby surfaces reflect the arc. Photochemical reactions between ultraviolet radiation and chlorinated hydrocarbons produce phosgene and other decomposition products. The ozone can be kept from a welder's breathing zone with a low-velocity, high-volume ventilation flow. Health professionals briefed employees on the effects and hazards of exposure to ozone. Inhalation of ozone at greater than the limits can cause eye and mucous membrane irritation, pulmonary edema, and chronic respiratory disease. The briefing included mention of four published limits for ozone exposure.

- OSHA personnel exposure limit: 0.1 ppm
- American Conference of Governmental Industrial Hygienists, Inc., established limits: 0.05 ppm, heavy work; 0.08 ppm, moderate work; and 0.1 ppm, light work
- National Institute for Occupational Safety and Health value immediately dangerous to life or health: 5.0 ppm

OEAF engineers searched the ORPS database for related events dealing with the production of ozone during the welding process and found the following.

- Industrial hygiene personnel at Sandia National Laboratory measured ozone at three times the OSHA personnel exposure limit while a plasma cutting torch was in operation. Medical staff who examined eight individuals exposed to the elevated ozone level reported that five complained of respiratory irritation. (ORPS Report ALO--KO-SNL-9000-1997-0005)
- Industrial hygiene personnel at the Paducah Gaseous Diffusion Plant measured ozone at greater than the American Conference of Governmental Industrial Hygienists, Inc., ceiling limit while a mechanic was gas tungsten arc welding on stainless steel. The job was temporarily suspended while ventilation equipment was placed into service. (ORPS Report ORO--MMES-PGDPFABMNT-1991-0013)

These events illustrate the hazards associated with arc welding and plasma cutting of reflective metals. Maintenance managers and supervisors should ensure that personnel understand hazard controls unique to welding operations. Guidelines and limits are addressed in the following documents.

- ANSI/ASC Z49.1-94, *American National Standard for Safety in Welding and Cutting*, provides guidance for performing welding and cutting operations safely.
- 29 CFR 1910.252, subpart Q, *Welding, Cutting*, *and Brazing,* section (c), addresses health protection and ventilation. It requires local or general ventilating systems arranged to keep the amount of toxic fumes, gases, or dusts below the maximum allowable concentration, as specified in 29 CFR 1910.1000.
- 29 CFR 1000, subpart Z, *Toxic and Hazardous Substances,* prescribes limits for employee exposure to air contaminants.

**KEYWORDS**: welding, ventilation, job-hazard analysis

**FUNCTIONAL AREAS**: Mechanical Maintenance, Industrial Safety

## 7. ACCESS CONTROL DISCREPANCIES AT LOS ALAMOS

On October 21, 1998, at the Los Alamos National Laboratory Waste Management Facility, training staff personnel checking training records discovered that a contractor employee had

never received biennial general employee radiological refresher training and that he was initially trained over two years ago. Investigators determined that the employee was improperly permitted access to radiological controlled areas after his training had lapsed because a deactivation date was incorrectly entered into an access control system. Training staff personnel immediately deactivated the contractor employee's access to radiological controlled areas. The employee completed retraining and the correct activation dates were entered into the access control system. Expired training can lead to a decrease in worker proficiency and knowledge and may have an adverse impact on the environment and on the safety of personnel. (ORPS Report ALO-LA-LANL-WASTEMGT-1998-0005)

Investigators determined that dates for various training courses are entered into the access control system and that training personnel believed that the database software checked all fields, selected the nearest date, and denied access if any training had expired. However, investigators determined that some of the training dates are text fields and, as such, are not checked for expiration by the software program.

The facility manager held a critique on this event. Critique members learned that the biennial general employee radiological refresher training is assumed to be completed when employees successfully fulfill the requirements, which may be done in a number of ways, including participation in a radiological safety meeting. They learned that the contractor employee had viewed an emergency action plan video, that this video covered radiation safety issues, and that employees must view it annually to maintain unescorted access to controlled areas. They also learned that although the video might be understood to constitute adequate general employee radiological refresher training, the employee viewed it by coincidence and not because anyone recognized that his refresher training had expired.
The facility manager directed facility personnel to perform the following actions.

- Employees must produce proof of radiation training to access control clerks before entering radiological controlled areas.

- An access control team will continue to review access control data discrepancies and correct them as necessary.

- Facility personnel will improve the facility access control database to ensure that training dates are correctly recorded.

NFS has reported occurrences involving expired qualifications in several Weekly Summaries. Following are some examples.

- Weekly Summary 98-11 reported two events involving expired radiological control qualifications at the Hanford Site. On March 9, 1998, a radiation control technician granted a thermal insulation worker access to a radiologically controlled area based on erroneous data in the Access Control Entry System (ACES). The ACES administrator had failed to update the system when training personnel informed him that the worker had failed a module of the computer-based training for Radiation Worker II requalification on March 3, 1998. On March 12, 1998, personnel in the radiochemical processing group discovered that Radiation Worker II qualifications for a worker had expired on February 28, 1998. The worker had been entering radiologically controlled areas after his qualifications had expired because information in the ACES failed to note that his training had expired. (ORPS Reports RL--PHMC-FFTF-1998-0005 and RL--PNNL-PNNLNUCL-1998-0002)

- Weekly Summary 97-05 reported that a custodial officer at the Savannah River Site FB-Line discovered that six waste-handling operators' Resource Conservation and Recovery Act (RCRA) training had expired and that the operators had

performed RCRA-related waste handling activities after their annual training expired. (ORPS Report SR--WSRC-FBLINE-1997-0006)

- Weekly Summary 96-50 reported that Manufacturing Division personnel at the Pantex Plant identified a production technician who had performed work without being fully qualified. The technician lacked courses on general work practices required by plant procedures. (ORPS Report ALO-AO-MHSM-PANTEX-1996-0236)

- Weekly Summary 95-31 reported that a shift manager performed work at the Hanford Plant with an expired certification. Investigators found that certifications had expired or were about to expire for 50 percent of the shift managers. DOE granted a 90-day extension to allow their recertification. Corrective actions included providing a status report that identifies re-certification training needs 60 days before expiration. (ORPS Report RL--WHC-PFP-1995-0040)

OEAF engineers searched the ORPS database for events involving expired qualifications and found 52 reports. Figure 7-1 shows the distribution of root causes for these occurrences. A review of these occurrences shows that managers reported management problems as the root cause in 62 percent of the occurrences for which a root cause was identified. Further review shows that managers attributed 50 percent of the management problems to inadequate administrative control and 28 percent to policy not adequately defined, disseminated, or enforced.

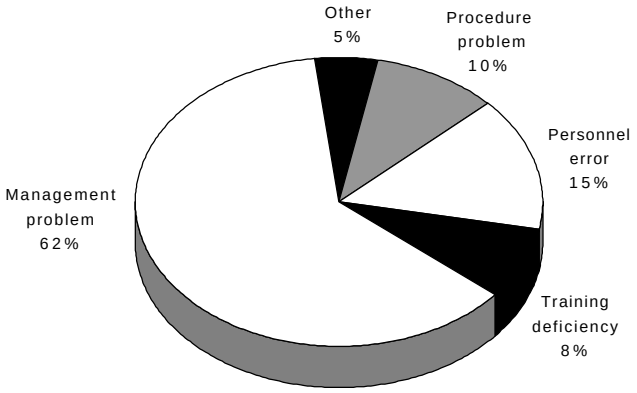


**Figure 7-1. Root Causes for Expired Qualifications[1]**

These events illustrate the need for training coordinators, facility managers, and access control system administrators to review their training program records and controls to ensure that staff are qualified and certified for the tasks to which they are assigned. Employees should also accept the responsibility for meeting qualification requirements. Supervisors should be able to easily track the status of training for workers so that training can be scheduled in an effective manner.

Facility managers should ensure that computer programs are independently verified and audited to provide confidence that they adequately reflect operational, functional, and technical requirements. Personnel who use these programs should have a thorough understanding of all

[1] OEAF engineers searched the ORPS database using the graphical user interface for all narrative containing (expire* OR lapse*)<NEAR/6>(train* OR qualif*) AND NOT FEMP. All FEMP occurrences with narrative satisfying this search string are nearly identical reports on controlled substance violations. Based on a random sampling of 20 events, OEAF engineers determined that each slice is accurate to within ±5 percent.

code aspects, so data is not incorrectly entered or interpreted. Facility managers should also ensure that workers understand they are responsible for attending the required training.

- 10 CFR 835.902, *Radiological Workers*, states that radiological worker training programs and retraining shall be established and conducted at intervals not to exceed two years to familiarize workers with the fundamentals of radiation protection and the ALARA (As Low As Reasonably Achievable) process. Training must include both classroom and applied training.

- DOE O 5480.20, *Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities,* provides requirements for ensuring that all workers are qualified to carry out their assigned responsibilities. Chapter I, sections 7.a.(1) and 7.a.(2), sets forth requirements for developing and maintaining training to meet the position requirements. Requirements for initial and continuing training can be found in sections I.7.c and I.7.d.

- DOE O 1330.1D, *Computer Software Management*, provides guidance for establishing a computer software management program, including quality assurance and quality control.

- DOE O 1360.4B, *Scientific and Technical Computer Software*, provides guidance for the management and control of scientific and technical software.

- DOE/EH-0256T, *Radiological Control Manual,* section 122, states: "Minimizing worker radiation exposure can be achieved only if all persons involved in radiological activities have an understanding of and the proper respect for radiation." Section 123 provides specific guidance on radiological worker responsibilities. Managers at facilities with radiation areas should review their programs to ensure that workers are aware of and comply with this guidance.

- DOE-STD-1060-93, *Guide to Good Practices for Continuing Training*, chapter 7, requires auditable records of personnel training. It also states that supervisors "should have access to qualification records, as necessary, to support the assignment of work to qualified personnel." DOE standards are available on the Department of Energy Technical Standards website at http://www.doe.gov/html/techstds/standard/standard.html.

- DOE/EH-0502, Safety Notice 95-02, *Independent Verification and Self-Checking*, September 1995, provides guidance and good practices for performing independent verification. Safety Notice 95-02 can be obtained by contacting the ES&H Information Center, (800) 473-4375, or by writing to U.S. Department of Energy, ES&H Information Center, EH-72, 19901 Germantown Rd., Germantown, MD 20874. Safety Notices are also available at http://tis.eh.doe.gov:80/web/oeaf/lessons_learned/ons/ons.html.

**KEYWORDS:** access control, administrative control, radiological work permit, training and qualifications

**FUNCTIONAL AREAS:** Radiation Protection, Training and Qualification

## 8. PIPE FITTERS VIOLATE FALL PROTECTION PROCEDURES

On October 23, 1998, at Los Alamos National Laboratory Plutonium Processing and Handling Facility, a facility management walk-around team observed two subcontractor pipe fitters violating fall protection procedures while installing copper tubing for a boiler replacement project. One pipe fitter was standing on a 3-inch diameter pipe suspended 10-12 feet above the floor and the other was on a stepladder and attempting to hold acetylene bottles while performing soldering operations. Neither pipe fitter was using any fall protection equipment, which violated facility procedures and OSHA requirements. The facility management walk-around team immediately directed them to stop work. Failure to follow safety procedures resulted in the suspension of elevated work and could have resulted in an injury or fatality. (ORPS Report ALO-LA-LANL-TA55-1998-0048)

Investigators determined that the foreman was at the job site approximately 15 minutes before the management team had arrived. He observed the pipe fitters working and directed them to finish up and clean the area. The pipe fitters continued to work because they believed that the foreman meant for them to complete the entire pipe installation instead of just the section they were working on. Investigators determined that the foreman was aware that work above 6 feet required scaffolding and that he had asked for scaffolding to be installed. They also determined that the pipe fitters had attended a pre-job briefing and that the foreman believed that they understood the required job controls. Investigators determined that 10 activity hazard analyses were contained in the boiler replacement work package and that the size and complexity of the package may have made it more difficult for the workers to understand the requirements. They also determined that one of the pipe fitters had not signed the activity hazard analysis for scaffold usage.

Investigators determined that the workers had not received (1) general hazard awareness training, (2) scaffolding training, or (3) ladder safety training. They determined that one pipe fitter had been recently hired and that procedures allow untrained workers to perform work when they are accompanied by trained workers. However, the other pipe fitter was himself not trained, although he had been employed since 1975. The facility manager will develop corrective actions as necessary.

OEAF engineers reviewed a recent similar event at the Los Alamos National Laboratory Tritium Salt Facility. On October 28, 1998, a carpenter received head lacerations and two broken ribs when he fell while installing drywall above a false ceiling. The carpenter was standing on an 8-foot A-frame stepladder that was positioned perpendicular to a wall when he fell. (ORPS Report ALO-LA-LANL-TSF-1998-0003)

OEAF engineers also reviewed a fall protection event that occurred at Lawrence Berkeley National Laboratory in 1996. On July 2, 1996, a subcontract worker was hospitalized with fractures to his wrist, leg, and spinal vertebra after he fell approximately 16 feet through a metal deck opening. A special joint investigation committee of Lawrence Berkeley and DOE personnel conducted a Type B accident investigation of this event. Lawrence Berkeley managers developed corrective actions, which included requiring safety personnel to perform daily safety compliance inspections. (ORPS Report SAN--LBL-OPERATIONS-1996-0003 and *Type B Accident Investigation Board Report on the July 2, 1996, Fall with Serious Injuries*)

NFS has reported numerous fall protection violations and fall-related injuries in the Weekly Summary. Following are some examples.

- Weekly Summary 98-05 reported that a construction safety coordinator at Lawrence Berkeley National Laboratory performing a daily safety compliance inspection observed subcontractor workers violating safety procedures while removing ductwork. One worker was standing on a crane walkway without the crane being locked out or tagged out, in violation of facility procedures. Another subcontractor worker was working on a maintenance platform that was

approximately 25 feet high without using fall protection equipment. (ORPS Report SAN--LBL-OPERATIONS-1998-0002)

- Weekly Summary 97-44 reported that a subcontractor pipe fitter at the Oak Ridge National Laboratory fell 15 feet through a roof opening of a tank vault building, landing on wooden scaffold decking. The pipe fitter fell when a temporary plywood cover he was walking on dislodged. (ORPS Report ORO--LMES-X10CM-1997-0005)

- Weekly Summary 97-42 reported that a safety inspector at the Los Alamos National Laboratory initiated a stop-work order to a roofing subcontractor because of repeated fall protection violations. In the final event, the safety inspector observed a subcontractor safety monitor assisting in roofing activities after he had been counseled that his purpose was to be a dedicated safety monitor with no other responsibilities. (ORPS Report ALO-LA-LANL-LANL-1997-0002)

- Weekly Summaries 96-27 and 96-08 reported a fatal fall at the Idaho National Engineering Laboratory. A subcontractor project engineer, who was not wearing fall protection, fell 17 feet from a temporary platform. The engineer suffered severe head and neck injuries and died. The temporary platform had no guardrails, toeboards, or other fall protection. The Office of Environment, Safety and Health issued a Type A Accident Investigation Board Report stating that hazards were not identified and there were no barriers in place to prevent the accident. (INEL Lessons Learned #96116, OEWS 96-08, *Type A Accident Investigation Board Report on the February 20, 1996, Fall Fatality at the Radioactive Waste Management Complex Transuranic Storage Area - Retrieval Enclosure*, ORPS Report ID--LITC-RWMC-1996-0001)

OEAF engineers searched the ORPS database for reports involving a lack of fall protection and found 95 occurrences. Rates and the trend of occurrences were established by normalizing the number of occurrences to the number of hours worked. Reporting of fall protection issues was relatively constant until the first quarter of 1996, when a fall fatality occurred at Idaho National Laboratory. After the Idaho event, DOE facilities apparently became more aware of the safety issues involved and were finding and reporting more occurrences. However, this trend has declined since 1996, and occurrences are currently being submitted at a slightly higher rate than before the Idaho event. Figure 8-1 shows the distribution of occurrences by year (note that the data for 1998 is not data for the full year) versus the number of occurrences per 200,000 hours worked.

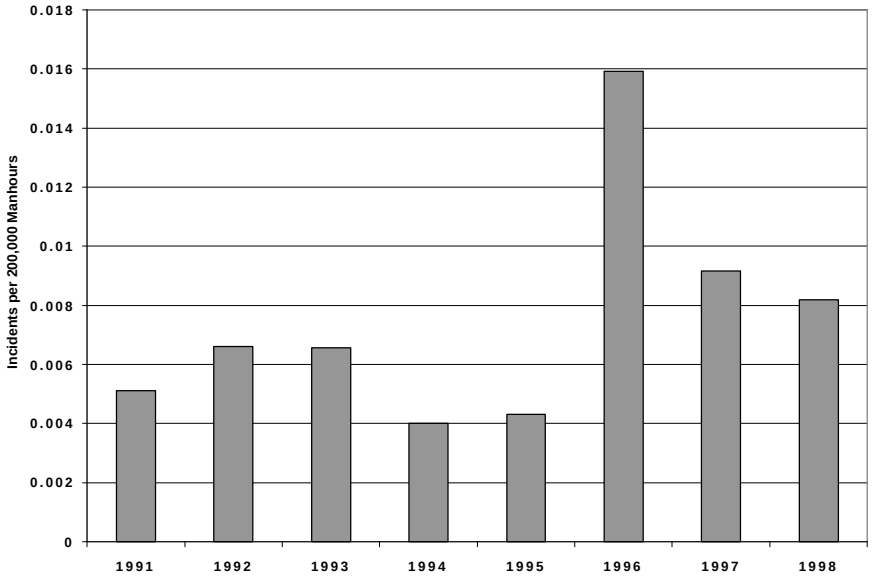


**Figure 8-1. Lack of Fall Protection Events**[2]

The Office of Environment, Safety and Health addressed fall protection in Safety & Health Note, DOE/EH-0489, "New OSHA Booklet on Fall Protection in Construction." The booklet provides a generic overview of fall protection. It states: "In the construction industry in the U.S., falls are the leading cause of worker fatalities. Each year, on average, between 150 and 200 workers are killed and more than 100,000 are injured as a result of falls at construction sites. OSHA recognizes that accidents involving falls are generally complex events frequently involving a variety of factors. Consequently the standard for fall protection deals with both the human and equipment-related issues in protecting workers from fall hazards." The booklet provides guidance for employers and employees to follow when protection is required and discusses how to select fall protection systems.

DOE facility managers should review requirements and procedures to ensure that employees are familiar with both site and OSHA requirements for fall protection when elevated work is being performed. OSHA requires that an employee engaged in elevated work be protected from falling by (1) a guardrail system, (2) a safety net system, (3) a personal fall-arrest system, or (4) a combination of a warning line system and guardrail system or a warning line system and a safety monitoring system. Employees performing elevated work on platforms 50 feet or less in width are required to use a safety monitoring system.

- DOE O 4330.4B, *Maintenance Management Program*, chapter II, section 8.3.6, "Control of Non-Facility Contractor and Subcontractor Personnel," states that nonfacility contractor and subcontractor managers should be held accountable for the work performed by their personnel. Section 8.3.3 requires maintenance supervisors to routinely monitor maintenance activities to ensure they are in accordance with DOE and facility policies and procedures, including monitoring of industrial safety practices.

[2] OEAF engineers searched the ORPS database using the graphical user interface for reports that contained all narrative of <order><sentence>("no","fall","protection") OR <order><sentence>("without","fall","protection") and found 95 events.

- OSHA regulation 29 CFR 1926.501, *Duty to Have Fall Protection*, requires employers, except for those involved in steel erection, to determine that walking/working surfaces have the strength and structural integrity to safely support their employees. The regulation further states that each employee on a walking/working surface with an unprotected side or edge that is 6 feet or more above a lower level must be protected from falling by a guardrail system, a safety net system, or a personal fall-arrest system.

- OSHA regulation 29 CFR 1926.502, *Fall Protection Systems Criteria and Practices*, requires employers to provide and install fall protection systems for employees and to comply with all other pertinent requirements before employees begin work that necessitates the fall protection. Effective January 1, 1998, OSHA no longer includes body belts as an acceptable personal fall-arrest system.

A copy of the Safety & Health Note can be obtained by accessing the website http://tis.eh.doe.gov:80/docs/bull/links.html or by calling (301) 916-4444. To obtain a copy of the OSHA booklet, contact the local regional or area OSHA office (listed in the telephone directory under U.S. Department of Labor) or write to OSHA Publications Office, 200 Constitution Ave., NW, Room N-3101, Washington, DC 20210. OSHA regulations can also be found at http://www.osha-slc.gov/.

**KEYWORDS:** construction, fall protection, injury, near-miss

**FUNCTIONAL AREAS:** Construction, Industrial Safety